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ABSTRACT

Three hypotheses were tested in this 6-week study: a) training in systematic application of strategies designed to reinforce desirable pupil behavior would enable the teacher to develop and maintain classroom control and increase pupil learning; b) desirable pupil behavior thus produced could be transferred from one classroom to another in which the teacher was not using the strategies; and c) pupils would respond to the change in teaching strategies despite previous histories of disruptive behavior. In addition to utilizing a token reinforcement program, the design emphasized teacher training, involved the manipulation of surrounding conditions and curriculum variables, and employed video tapes both in training and in subsequent measurement and analysis. The token reinforcement system, which enabled students to use points earned for desirable behavior to purchase various items, was introduced to Room B--half of a classroom of 18 students. Students in Room A earned desirable behavior points in order to gain entrance to Room B. During the course, desirable pupil behavior increased approximately 30%. The reinforcement rates of both teachers increased. Desirable pupil behavior was found to be a function of teacher reinforcement. The results of the study support the hypotheses tested, but further research is needed to reach a greater level of sophistication in the definition of teaching techniques that work. (HMD)

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Monograph Number 5

BEHAVIOR MODIFICATION AND TRANSFER IN AN OUT-OF-CONTROL CLASSROOM

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Educational Differences

Harvard University
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Relatively few experimenters have attempted to apply behavior modification techniques to the public school classroom. Of the research that has been carried out, the primary emphasis has been upon maintaining laboratory conditions in the school (e.g., Bijou and Baer, 1960), and in maintaining a high degree of stimulus control through the use of programmed learning materials (e.g. Birnbrauer et al., 1965; Cohen et al., 1967). The latter research has been carried out in predominately institutional settings, and with rather specialized populations.

Attempts to apply operant procedures to the classroom continue to excite interest. Researchers such as Allen (1967) have successfully defined, and through the systematic application of reinforcement, have been able to modify a variety of verbal and social behaviors in individual nursery school children.

More recently, O'Leary and Becker (1967 a , 1967 b) have attempted to extend such procedures to in-school classrooms, and have employed token reinforcement systems with sub-samples of a given class.

The trend appears to be to adapt behavior modification procedures in such a way that they can eventually be made directly available to a single teacher working in a regular classroom. Such attempts are beset with problems of adequate experimental control, as those who have worked in the area will quickly point out.

Major variables apart from the reinforcement procedures include the physical setting, curriculum, and the teacher's ability to apply relevant techniques in setting up optimal

conditions for learning These latter variables interact with and influence the reinforcement system in operation. However, the greatest attention to date has been paid to reinforcement conditions per se While there have been a few attempts to manipulate curriculum through the selection of programmed materials, the basic interest has centered around stimulus control.

The present study bears some similarity to the O'Leary and Becker (1967 a) research, in that it employs a token reinforcement system in an out-of-control classroom. However, in addition to manipulating reinforcement conditions, the focus was broadened.

An attempt was made to institute total environmental control at the outset by manipulating variables associated with teacher behavior, surrounding conditions, and curriculum. It was hypothesized that training in the systematic application of strategies designed to elicit and reinforce desirable pupil behaviors would enable the teacher to develop and maintain classroom control and increase pupil learning.

A second hypothesis was that the desirable pupil behavior thus produced could be transferred from one classroom to another in which the teacher was not using the strategies.

Finally, it was predicted that despite a prior history of disruptive behavior under conditions of aversive or ineffective teacher control, pupils would respond to the change in teaching strategies by the teacher.

METHOD

General Procedure: The subjects for this study came from the combined third and fourth grade classroom in an elementary school (K through 4) located in an urban ghetto area. There were 18 pupils in the class: 16 were Negro, 12 of the 18 were boys, and 11 of the pupils were enrolled in Grade III. Pupils ranged in age from 9 to 13 years.

Two teachers, the regular teacher and an intern teacher, were in charge of the class. The first (T_1) had 6 years teaching experience, was a Negro, and in his early thirties. The intern teacher (T_2) had no previous teaching experience, was white, and in her early twenties. She shared teaching duties with T_1 in the mornings only, then returned to the university for course work each afternoon.

The educational ethos of the school was clearly experimental. Teachers were encouraged to be inventive both in terms of curriculum selection and classroom organization. The central goal was to develop and maintain an educational milieu that would be truly responsive to the needs of the pupils. In keeping with these aims, certain elements of traditional social and administrative organization had been erased. For example, the teacher in many schools may refer unruly students to "the front office" -- to the principal, guidance personnel or some other administrator who will discipline the student. In this school, however, such was not the case. When disruptive pupil behavior did occur, the teachers were expected to handle the problem without calling upon front office forces to quell pupil uprisings.

In the combined third and fourth grade classroom, disruptive pupil behavior reportedly constituted a serious problem from the beginning of the school year. The resident teacher (T_1) felt that the class included a number of "problem" children, and this in combination with the lack of"backup" support from the front office intensified the problem.

Observations of both teachers indicated that pupil behavior in the classroom was, for the most part, impulsive, aggressive, and destructive. Neither T_1 nor T_2 was able to prevent pupils from taking apart their slotted wooden desks, tearing up classmates' papers, throwing books, yelling and singing. The noise level in the room was such that one could frequently hear the class from any one of the rooms in the three story building.

Aggressive pupil behavior was of central concern. In one 20 minute period, T_2 recorded aggressive acts in the classroom. She found that while not every child had acted as an aggressor, every child in the room had been struck by another one or more times during that period. Serious fighting occurred periodically during class time, and the teachers felt required to physically restrain pupils as they feared that serious physical injury would result. These occurrences were highly disturbing since they could only restrain two or three pupils at best, while the others involved fought on unrestrained.

Finally, the teachers were not able to stop pupils from running out of the classroom, through the halls, into other classes and offices, or outside of the school. Attendance records were almost impossible to

keep, as certain pupils arrived one to two hours late, and at any given moment of the day, a room count would show anywhere from 6 to 14 pupils present, with others in different parts of the building.

All of the above behaviors occurred with unpredictable and varying intensity, all were recorded in the two week period immediately preceeding the study, and all had reportedly been occurring in some strength for the past three months. Concern throughout the school had crystallized around the general noise level of the class, and the problems of keeping the children in the classroom.

Efforts to split the class into two groups so that each teacher could work with a smaller number of pupils had not proved successful. Curriculum materials selected for their potential interest value had not led to noticeable improvement, as disruptive behavior was so frequent that few pupils attended to the lessons. Conferences with the consulting clinical psychologist and the parents of some of the children had led to the conclusion that four of the children were clearly disturbed and required treatment. Treatment at a city clinic had begun, but had not apparently led to any improvement in classroom behavior.

An initial request for help came from T_2 who had taken a psychology course from one of the authors in the previous semester. Permission to conduct a study, which incorporated behavior modification procedures designed to increase classroom control, and beyond that to engage the children in more desirable learning activities, was obtained from the principal, T_2, and one of the school's trustees.

We proposed that the classroom be divided into two smaller rooms, and that we attempt to establish "total" milieu control in one of the rooms (Room B) through the application of conditioning and modeling procedures. Experimental conditions were to be organized in such a way that desirable changes in pupil behavior produced in Room B could be expected to transfer to Room A. This transfer of control hypothesis constituted one of the basic experimental aims of the study.

The strategy in brief was to attempt to achieve effective teacher control at the outset, then following this initial phase, to gear the contingencies to emphasize increases in pupil attention or perseverance with learning tasks (time on task behavior) in individual study and in teacher-pupil discussion lessons.

Design: The study was run over a 6 week period, and was divided into four steps or phases, shown in Table 1. As mentioned earlier, in addition to utilizing a token reinforcement program, the design emphasized teacher training involved the manipulation of surrounding conditions and curriculum variables, and employed the use of videotape both in training and in subsequent measurement and analysis.

(1) Pretraining Observations: Prior to teacher training, samples of pupil behavior were recorded on videotape. In the first of these three one hour tapes, and on all succeeding school days through the end of the experiment, 12 randomly determined, 5 minute segments of pupil and teacher

Table 1

Summary of Phases and Time Sequence in Training[1]

Phase of Training	Time Sequence	
	Experimental Day/Tape	Week
PHASE 1: Pretraining Observation	1-3	1
Classrooms divided into Rooms A and B. Intern (T_2) begins training.	(Two-day school holiday between days 3 and 4.)	
PHASE 2	4-5	2
Each half of class initially exposed to Room B conditions for one day.		
PHASE 3	6-17	3-5
Transfer of control from Room B to Room A initiated.	6	
Regular teacher (T_1) begins training. (T_1 was absent on days 13, 14, and 15.)	12	
PHASE 4	18-21	6
Teachers switch rooms: T_1 moves into Room B; T_2 moves into Room A.	18	
End of videotaping.	21	

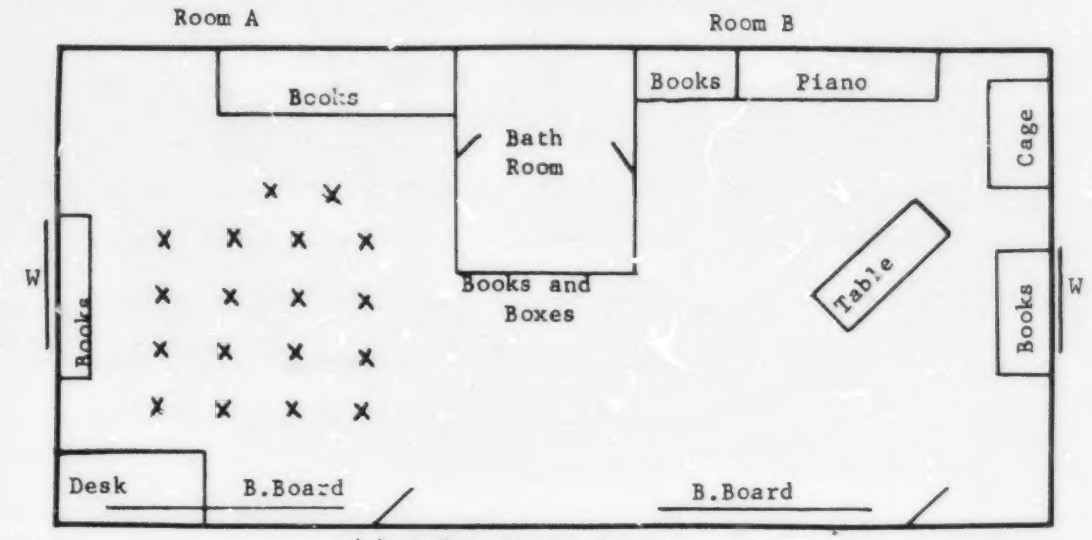
[1]From experimental day 6 onward, pupils rotated from Room A to Room B. Rotation was based on the number of points each pupil earned. The 7 top point-getters in Room A on any given day moved to Room B the next day. The 2 top point-getters in Room B on any given day remained in Room B the next day (cf. Transfer of Control, pp. 17-18).

behavior were recorded each day. Thus, 4 randomly determined 5 minute segments of classroom behavior were recorded for every 60 minutes of class time.

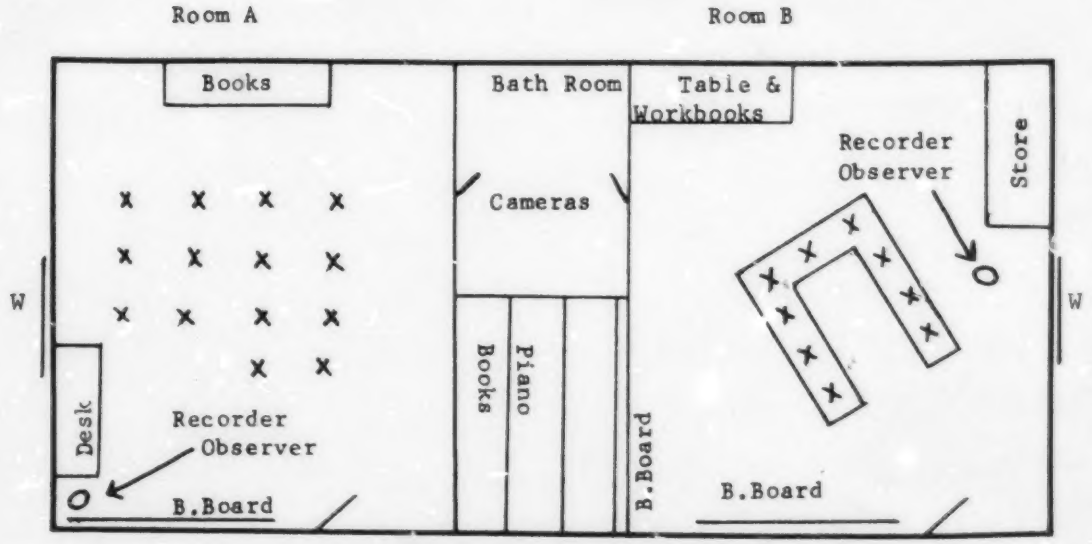
On the first day, all pupils were in Room A as was the usual arrangement. On tapes 2 and 3, the classrooms were split into two smaller rooms, and 2 cameras equipped with wide-angle lenses were used from this point on.

The location of the videotape equipment and the changes in room conditions are depicted in Figure 1. Camera equipment was placed in the bathroom, and small holes (approximately 10" x 4") were cut in the upper panel of each bathroom door. The camera lenses while visable were small (1½" diameter) and did not project beyond the openings in the doors. The wide-angle lenses permitted the operator to televise a given class without panning the cameras back and forth. Thus while everyone in the classroom knew that the equipment was present, no one could tell when it was operating. The equipment was soundproofed by being enclosed, and videotaping in either room was controlled by a switcher. The operator arrived each morning before the school was opened, and locked himself into the room. A multidirectional microphone was hung among the lights in each room, and proved to be effective and unobtrusive.

It should be noted that tapes 2 and 3 are used in the presentation of results. They do not constitute true baseline observations, but reflect the effects of initially splitting the rooms into two sections, and those due to the introduction of videotape equipment. They were recorded following a brief T.V. equipment desentization period.



(a) Before Room Changes



(b) After Room Changes

Figure 1. Schematic representation of the rooms before and after changes were instituted. In the pretreatment phase the classes were split, but the room divider had not been put up (see top diagram (a). From phase 2 on, the rooms were divided, the "store" added in Room B, and Rooms A and B were cleaned, and desks rearranged, as seen in (b).

(2) Establishing Control in Room B: Following the initial week of pre-treatment observation, pupils were exposed to experimental Room B conditions. The class was randomly split into two sections, each of which was assigned to Room B on alternate mornings.

It was at this point in the experiment that we attempted to institute total milieu control. The plan was to transform Room B into a highly desirable environment. This required changes in surrounding conditions, curriculum, teacher behavior, and the inclusion of a token reinforcement program. Each is discussed in turn.

(a) Room Changes: The rooms were to be divided in two by moving the piano over to the center section, and screening it with a large portable blackboard. Before phase 2 began, all books were removed from the room. All child art and other posters were removed. In their stead, selected content-relevant posters were put up and changed as curriculum changed. The slotted desks were joined together to form a U-shaped table which, as can be seen in Figure 1(b), was strategically located so that the teacher could control the door, and more importantly, was encouraged to move from the blackboard into the U, over to the work table, in short to vary the stimulus situation by physical movement.

Finally, all extra desks and furniture such as the animal cage were removed, and a "store" was set up in the right corner of the room (its contents are described below). In sum, room changes were made to reduce extraneous stimulation, to make the room more physically attractive, to

facilitate teacher control, and to require her to teach from various teaching positions.

(b) Teacher training: The general strategy of the study, vis a vis teacher training was to train the intern teacher (T_2) in Room B while T_1 continued to do his best in Room A. Following this, the teachers would switch rooms and T_1 would then receive training under Room B conditions. This plan was followed. T_2 received training in Room B until day 18. T_1 received initial training following tape or experimental day 12 while still in Room A, then switched into Room B on day 18. The resident teacher (T_1) was absent for three days (13-15) with Asian flu, and thus T_2 remained in Room B until he returned. In the interim, two different substitute teachers taught in Room A.

Both teachers received training in verbal, nonverbal and token reinforcement procedures. In addition they were trained in basic questioning procedures (probing) and methods of varying the stimulus situation. The latter techniques refer to verbal and nonverbal alternatives which the teacher may use to elicit attention and curiosity. These instructional strategies served to translate the notion of "shaping" into concrete teacher behavior. They were used to initially elicit desirable behavior, which could then be reinforced. They were presented as techniques designed to prevent disruptive behavior, as opposed to corrective techniques following lapses in control. More detailed outlines of the techniques or instructional strategies in question can be found elsewhere (Orme, 1967; Orme, 1966; McDonald, Orme and Allen, 1966).

The teachers also received training in specifying the goals of instruction in terms of pupil behavior, the differential reinforcement of pupil time on task behavior, pupil silence, handraising, pupil-pupil cooperation, pupil comments, questions and answers, pupil attending to another pupil discussing lesson content, and related educationally relevant behaviors. In general, the teacher was encouraged to engineer desirable pupil responses that were incompatible with disruptive pupil behavior, then to reinforce the former with tokens, verbal and nonverbal reinforcement. They were directed to ignore disruptive behavior (short of fighting, which did not reoccur at any time during the experimental period) by focusing on an adjacent pupil modeling desirable behavior.

In initial training, each teacher's pre-treatment videotapes were analyzed in sessions with E. He presented the general notion of the teacher as an hypothesis maker, i.e., one who has available a series of viable alternatives in responding to certain classes of pupil responses. Thus the sessions were geared to build on each teacher's existing strengths, to reinforce desirable teacher behavior, and to extend present skills through verbal and direct modeling by E.

Each teacher received 6 of these combined response-guidance and feedback sessions. Videotapes from different lessons were used in each session. The initial session lasted for approximately two hours. Subsequent sessions lasted approximately 50 minutes. $Teacher_1$ was exposed to this training over an 8 day period (from day 12 to day 20). The

intern teacher (T_2) had three sessions between days 4 and 7, then participated in the next three sessions on experimental days 9, 13 and 18. The sessions with T_2 tended to be shorter and less intensive than those with T_1. The former was highly responsive, and appeared to grasp the general principles and specific techniques rapidly. On the other hand, while T_1 was responsive to training, he was much more prone to initial speculation about the underlying motives that pupils might or might not have for disruptive behavior. This behavior noticeably diminished in strength by the end of the second session.

(c) Curriculum: In anticipation of achieving control in Room B, the selection of viable curriculum materials became a realistic concern. Neither T_1 nor T_2 were given direct suggestions. T_2 was encouraged to select particular content with an eye to its "control potential," as well as for its probable educational value. (I.e., choral reading and drama for example, were used in teaching English literature. These procedures require a relatively high level of cooperative verbal behavior on the part of class members, thus providing opportunities for appropriate teacher reinforcement.) T_2 selected a primary school work book in math and geometry for use in individual study (high stimulus control, easily integrated with tokens for work completed, and work completed correctly). In reading, T_2 used a series of film strips which allowed her to flash symbols, words, and phrases on the classroom wall. These materials provided cue-discrimination

training in basic reading and vocabulary skills, while at the same time lending themselves to an interesting quasi-competitive situation in which T_2 directions ("Ready, set...go!) were immediately followed by desirable pupil responses (recording the material flashed on the wall). By way of final illustration, a social studies unit on cities was used, and included certain model materials and a film. These materials were introduced following desirable pupil behavior, rather than scheduling them into a pre-set lesson plan where their reinforcement value might well be squandered.

T_1 received the same general instructions as T_2 in regard to curriculum. Following initial training, he reduced the emphasis on traditional grammar and telling-the-time drills. Math drills were reorganized, the workbooks mentioned above were incorporated, and a social studies unit dealing with the Negro in America was revised to include role playing, selected posters and more teacher-pupil discussion. None of these procedures had been suggested to T_1. His initiative was of course commented upon in the training sessions.

(d) The Token Reinforcement Program: Unusual problems usually require unusual solutions. To be sure, token reinforcement systems are not a new idea. They are, however, perceived as unusual by a substantial majority of educators. Like other systems, the one in this study was set up in such a way that pupils could "earn" points by emitting certain specified behaviors. The points or tokens earned could then be used to

purchase preferred backup reinforcers from the "store." The token system described here differs from those outlined in the previous literature in that the pupils shared actively in the determination of point getting behaviors, and to a lesser extent in the determination of backup reinforcers. In addition, the range of store items available went considerably beyond the usual variety of primary reinforcers (candy, toys) to include educationally relevant reinforcers.

In view of the strength and frequency of disruptive pupil behavior, and the teachers' lack of reinforcement value in the classroom, the store included tangible items such as candy and gum. We could not be sure that the children would find more esoteric "reinforcers" reinforcing. Indeed, there was little or no evidence to indicate that they would be capable of delaying gratification long enough to accumulate any points. In anticipation of this, T_2 provided herself with a liberal quantity of small candies (they were not needed, as the children immediately set their sights on items requiring a fairly large number of points).

In addition to several kinds of candy, gum, ballons, baseball cards and the like, the store also included items such as: comics, selected novels and math puzzles, the opportunity to write poetry, a "conversation" with a computer (feed in disease symptoms for diagnoses), a short series of art lessons from a <u>real</u> artist, a model airplane together with instruction on aerodymanics, a ship building project,

science projects and puzzles, field trips to several types of museums and art institutions, and finally, an opportunity to attend a real lecture at a major university. Apart from the last (for which there were a few "nibblers," but no final takers), each of the "items" above were designed to provide further in-school opportunities for individual or small group study. Thus the student was given the opportunity to earn the right to select his own curriculum for a part of the school day.

All items were displayed on a table and a large white sheet of cardboard immediately above it. Trips, lessons and projects were illustrated on colorful cards, together with their prices. Small suckers and taffy twists were priced at 15 points (the cheapest items). From there, point-prices rose, with the highest priced items being the field trips and projects leading to preferred study. The latter ranged from 450 to 1000 points.

Upon initial exposure to the room all pupils were given 25 points to spend immediately. This was done to impress upon them the reinforcement value of points. Items were priced in such a way that if they purchased an item, they would still have 10 points left over. This meant they had only a few more points to earn before they could purchase another item. This was done to avoid short-term satiation effects, and to maintain a high incentive level.

Each pupil's name was listed on the front board. The recording and decision to give points was controlled by the teacher at all times. As the children came into the room, T_2 began selectively dispensing points, and continued to do this throughout the experimental period.

The system was explained briefly, and the point getting rules were outlined on the side blackboard. They were: Keep Busy All The Time, Have Good Manners, and Don't Bother Your Neighbor. The teacher pointed out that these were very general rules, and that the next few minutes would be devoted to allowing the pupils to suggest specific things that they thought should get points. The teacher then proceeded to list the do and don't behaviors suggested by pupils. Throughout this discussion, handraising, questioning (defining terms) and volunteered comments were reinforced verbally, nonverbally and with points.

Both teachers were trained to emit verbal and nonverbal "reinforcement" along with points on the assumption that the teachers' reinforcement value would increase through contiguous association with the point system. At the same time, they were told to reinforce only when they really felt that the behavior in question was desirable or approximated some desired terminal pupil response.

(3) Transfer of Control: In the first phase of the study, pretreatment observations were made. In the second phase, total milieu control in Room B was attempted. In the third phase, procedures were designed to facilitate the transfer of control produced in Room B, to Room A. This was done in the following way.

It was reasoned that in phase 2 , all pupils would be exposed to a highly attractive educational environment in Room B. They would want to stay there for many possible reasons perhaps, but most obviously for the chance to earn points which could later be exchanged at the store.

If the pupils' presence in Room B did in fact constitute a reinforcing state of affairs for him then it followed that one could set up contingencies in Room A in such a way as to take advantage of this. Accordingly, the entire class was brought together in Room A, after all had had initial exposure to Room B conditions. They were informed that no more than one-half the class could stay in Room B at any one time. The teacher then asked for suggestions or rules that could be set to gain entrance to Room B.

Pupils readily suggested that they be allowed to earn points in Room A, which could be used to gain admittance to Room B. (Points were to be recorded on the blackboard, opposite each pupil's name, as in Room B.) Through further discussion, it was agreed that points earned in Room A could only be used to gain admittance to Room B. They could not be used to purchase store items. Further, the two high point earners in Room B on any given day would be allowed to stay there the next day. As for Room A pupils, the seven earning the most points in that room on any given day would be allowed to go to Room B the next day. From this time on (experimental day 6), pupils names were posted on the door of each room every morning. In this way, a day by day flow of pupils through both rooms was maintained throughout the study.

Once these rules were set and understood, the pupils then went on to describe the kinds of behaviors that would yield points in Room A. As might be expected, the do and don't behaviors listed bore remarkable similarity to the behaviors outlined in Room B.

The resident teacher (T_1) who continued to do his best in Room A, proved reluctant to take on the added task of delivering points for specified pupil behaviors, as he felt at the time that it would jeopardize concentration on content and thus imperil control further. In anticipation of this reaction, a recorder-observer had received initial coaching, and he stood at the front corner of the Room A each day and recorded points for each individual, immediately following the emission of educationally relevant behavior.

The same recording procedures had now been set up in both rooms. In Room B, of course, T_2 administered all points. In Room A the recorder-observer fulfilled this function in the place of T_1 who continued to teach as usual. The recorder-observer in Room A was instructed to operate as a machine, to avoid any verbal interaction with pupils, and to ignore any overtures on their part.

In an attempt to partially balance the effects of introducing another person into the Room A environment, an observer was placed in Room B as well (see Figure 1-B). In order to maintain recording behavior, as did his counterpart in Room A, the Room B observer was instructed to rate pupil responses and teacher verbal reinforcement.

(4) Transfer of Teachers: In the fourth phase of the study, T_1 was transferred to Room B, while T_2 moved into Room A. The contingencies set up for the pupils in each room were not changed.

The transfer allowed T_2 to exercise her skills under classroom conditions that were less ideal than those in Room B. She was now required to exercise her skills without the direct support of the tangible reinforcement system available in Room B.

The switch also facilitated training for T_1, and gave him the opportunity to experience some of the possibilities inherent in the Room B token system. Most significantly, the arrangement ensured that when the study ended, he should be able to capitalize upon and extend his new skills in various phases of instruction, as well as benefit from the positive effects of increases in his reinforcement value as a teacher.

Finally, the experimenters were interested in assessing the relative importance of pupils' experiences with and reactions to both T_1 and T_2 under changed conditions of reinforcement. Their experiences with T_1 (prior to the experiment) had been primarily aversive. Their immediate past experiences with T_2 in Room B were expected to be highly positive. The question thus arose: Would pupils respond primarily in terms of their past associations with each teacher, or could their behavior best be explained in terms of the reinforcement contingencies set up in each room? It was hypothesized that despite a prior history of disruptive behavior under conditions of aversive control with T_1, pupils would quickly respond in terms of the contingencies operating in Room B. Expectations were that in Room A, pupils would likewise tend to respond more in terms of current reinforcement conditions than in terms of

what is generally termed teacher personality. If these hypotheses were viable then, we could expect pupils to continue to behave in ways which would gain them points in Room A, which they would then use to gain entrance to Room B. Once in Room B, their behavior should be essentially similar to what it was before the teachers switched rooms. In short, pupil behavior was expected to continue to be a function of the actual contingencies set up in each room, rather than a function of the individual teacher's personality. While their behavior could be expected to be influenced by their past reinforcement history with each teacher, these effects were expected to be relatively short-lived, and could be expected to be overridden by what the teacher was now doing, rather than by what he had done in the past.

If the hypothesis was not viable, then we could expect pupils to rebel against the system, and to attempt to remain in Room A with T_2 rather than moving into Room B with T_1, even though the latter condition allowed them to work for store items.

Measurement Procedures: It was mentioned earlier that for every three hours of class time in each room, 30 minutes were recorded in the form of six randomly selected 5 minute segments. At the end of the experiment then, we had 10.5 hours of videotape for each of the rooms. In addition, two 30 minute samples of classroom interaction in the afternoons (when all pupils were in Room A with T_1) were recorded. And, at the close of the study, a 10 minute structured interview with each pupil was taped.

Subsequent analyses of the videotapes involved independent ratings by trained observers of selected pupil and teacher behaviors.

(a) Pupil Behavior: Two teams of raters were trained to measure Pupil Time-On-Task Behavior and discrete educationally relevant and disruptive pupil behaviors.

The rating of discrete pupil behaviors included analyses of Pupil Responses: Questions, Answers, Comments, Pupil-Pupil Interactions and Pupil No-Response to Teacher Question or Statement Directed to the Pupil; Response Quality: each of the above responses, with the exception of pupil-pupil interactions, was rated as educationally relevant, i.e., relevant to the defined task at hand, or as irrelevant. This judgement was made following the recording of the actual pupil response. Time: On the rating forms developed to record discrete pupil responses, check marks were included at sixty second intervals throughout the segment being rated. An electric motor which turned a shaft at the fixed rate of 1 RPM was connected to a microswitch which activated a buzzer every 60 seconds. This was used to facilitate time recordings. Handraising: instances of pupil handraising were recorded as well. These included handraising which preceded any verbal response, and handraising which was accompanied by a verbal response.

Digressive Motor Behavior: This category included pupil behaviors such as: leaving the room, leaving one's seat, recurrent rocking in the chair, desk and/or chair shuffling, gross motor movements such as jerking,

exaggerated stretching and bending, turning around in one's chair. Digressive Verbal Behavior: Behaviors here included shouting, singing, screaming and "keening," as when one moans or hums over a period of time; Aggressive Motor Behavior: This category included fighting and striking others, regardless of the pupils' probable motivation for such acts (he could be angry or perhaps simply "joshing"another). Teacher Directions: In this category pupil responses to direct suggestions by the teacher, and to a given pupil, (not including generalized or group-directed suggestions) were recorded as follows, teacher directions (+), or does not follow teacher directions (-).

In addition, supplementary data including Lesson Type (Teacher-Pupil Discussion, Individual Study or Group Work), Total Tape Time, and Total Time Pupil Was On Camera were recorded for each segment.

Raters rated one pupil at a time, and recorded continuously. Initial training required approximately 20 hours. Five raters received initial training, and from among these, three went on to analyze the data reported in the next section. Inter-rater agreement was based on frequencies in one-minute periods. In the majority of studies treating data of this kind, inter-rater reliability is computed on the basis of frequency agreement for time intervals of up to 20 minutes in length. While such summated frequency comparisons may be closely related, it does not follow that they are recorded for particular responses at a given point in time.

Inter-rater agreement for the 5 raters, based on independent ratings of 12 segments randomly selected from 4 tapes, varied from 64 to 100 percent. Inter-rater agreement for the 3 raters who were selected to analyze the data is based on independent ratings of 21 segments, randomly selected from 7 tapes recorded and rated at points throughout the study. Agreement in this latter case varied from 75 100 percent. These data are presented in detail in Table 2.

The second major type of pupil behavior analysis was carried out independently of the analysis outlined above. A team of 3 raters, all of whom were given 10 hours of pretraining on discrete pupil response rating, were then given an additional 5 hours of training for pupil time-on-task analysis.

As was the case for the discrete response analyses, inter-rater agreement was built up by refining the definitions for each variable measured so that non-interpretative, independent measures of each relevant response was achieved. Definitions and copious examples of discrete behaviors within each category were incorporated into "raters manuals" which were reviewed prior to each session.

Pupil time-on-task behavior (TOT) refers to the amount of time the pupil spends on educationally relevant or desirable tasks. At the beginning of each lesson, the raters agreed on lesson-type, then specified those stimuli in the environment that were task relevant. For example, if the lesson was a teacher-pupil discussion lesson, then task relevant

Table 2

Interrater Agreement on Discrete Pupil Behavior Analyses

Response Category	Percentage of Interrater Agreement[1]	
	Initial Training[2]	Data Analysis
Pupil Responses:		
a) Questions	100	100
b) Answers	88	88
c) Comments	75	80
d) No Response	--	100
e) Pupil-Pupil Interaction	100	97
Handraising	83	95
Digressive Motor Behavior	64	83
Digressive Verbal Behavior	80	80
Aggressive Motor Behavior	--	100
Follows Teacher's Directions	--	100

1. Percentage of agreement was not computed when insufficient cases of a particular behavior made such computations questionable.

2. Initial training agreements are based on five raters who independently rated twelve segments selected from four tapes. Data analysis agreements are based on independent ratings of three raters on 21 segments selected from seven tapes taken throughout the study.

stimuli included the teacher, pupils who were verbally participating in an appropriate manner at a particular time (e.g., answering a question or making a lesson-relevant comment), the blackboard (if it was in use), relevant audio-visual aids and appropriate writing and textual materials if there was unequivocal evidence that these materials were part of the lesson. Once these task-relevant stimuli had been specified, each of the 3 raters then selected a given student, and observed eye movement and body orientation toward or away from task-relevant stimuli.

The potential disadvantage of the procedure is that raters may be forced to record behavior as (TOT) when the pupil is orienting to task-relevant stimuli, but could well be day-dreaming. On the other hand, a pupil may be gazing out the window and concentrating completely on the discussion at the same time. In this case raters would tend to rate such behavior as time-off-task. However, additional cues including body posture and verbal behavior tend to accompany time-on and time-off behavior, and these serve to facilitate rater discriminations that go beyond judgements based on gross body position and eye orientation alone. The reliability data reported below tend to lend credence to the procedure.

Recording procedures for TOT and time-off behavior were facilitated by the use of a continuous data event recorder. Pendant switches were attached to ink pens which continuously recorded separate lines on a paper strip which moved past the pens at a rate of 3 millimeters per second. When a given switch was activated, the pen to which it was linked moved up. Thus, it was possible to make continuous on-off

recordings of a given behavior which provided both frequency and duration of response data.

Each rater employed two switches. One was used for the TOT analysis, the other to record the frequency and duration of pupil-pupil interactions.

This method of recording permitted highly precise data in the determination of inter-rater reliability, and greatly facilitated training as well. Agreement was determined by the following formula:

$$\frac{\text{TOTAL AGREEMENT DISTANCE}}{\text{ABSOLUTE DISTANCE - TIME OFF CAMERA}}$$

The median rater agreement coefficients (in percent agreement) for time-on-task and time-on pupil interaction among the three raters were 93% (range = 77% to 100%) and 99% (range = 71% to 100%), respectively. These reliability indices were derived from five segments of three different tapes. The behavior rated was from nine different pupils.

(b) Teacher Behavior: A third team of 2 raters was trained to rate teacher verbal and non-verbal behavior on two separate rating forms. The Teacher-Verbal Behavior Form required frequency ratings of Teacher Questions, Pupil Responses, Response Quality of Pupil Responses, Teacher Controlling Statements, Positive Verbal Reinforcement, Negative Verbal Reinforcement, and Probing. The non-verbal form required similar measures of: Pupil Responses, Direction of Teacher Behavior (which pupil), Positive and Negative Non-Verbal Reinforcement, Changes In Teachers' Teaching Position, and Teacher Gestural Responses.

Since the training procedures and definitions of these responses have been reported elsewhere (McDonald, Orme, and Allen, 1966; Orme, 1967) they will not be discussed here.

Reliability data based on independent ratings of 21 segments drawn from 4 tapes are reported below in Table 3.

The data to be reported in the next section are not based on the entire videotape sample. Equipment development and the costly nature of rating necessitated the analysis of a reduced sample based on the tapes available. As will be seen in subsequent graphs and figures, the segments from 10 tapes were analyzed. The basis of selection was to select a representative number of tapes from the pretreatment, early, middle and later phases of the experiment. Actual tape selection was made by one of the research team members who had not seen the tapes prior to selection.

Table 3

Interrater Agreement on Teacher Verbal and Non-Verbal Behavior Analyses

Response Category	Percentage of Agreement	
	Average Agreement	Range of Agreement[1]
Response Quality (Pupils)	86	57-100
Teacher Controlling Statements	85	77-100
Teacher Reinforcement:		
a) Positive Verbal	83	75-88
b) Negative Verbal	100	-----
c) Positive Non-Verbal	84	76-88
d) Negative Non-Verbal	100	-----
Probing	85	82-94
Changes in Teaching Position	100	-----
Teacher Gestural Responses	82	74-93

1. Percentage of Agreement was computed for each segment rated. Average agreement constitutes the mean percentage of agreement over the 21 segments. Range of agreements indicates the two extremes of agreement obtained within each set of reliabilities.

RESULTS

In one sense, the present research constitutes a case study. A problematic classroom situation was encountered and treated. At the same time, however, experimental procedures were employed to test hypotheses derived from underlying principles of learning. An investigation was carried out which included the manipulation and measurement of relevant variables. In the presentation of results, this latter emphasis will predominate.

Both teacher and pupil performance data are presented below. Following a brief consideration of overall increases in desirable pupil behavior (Figure 2), data on teacher reinforcement rates during each phase of the study are presented (Figure 3). The focus then shifts to pupil time-on-task performance under each teacher (Figure 4). Finally, measures of discrete desirable and disruptive pupil behaviors are contrasted (Figures 5 and 6).

In all of these figures, the symbol C_1 (on the abscissa) denotes when experimental conditions and treatments were initiated; C_2 indicates the point at which T_1 (regular teacher) and T_2 (intern teacher) changed rooms. The reader will recall that T_2 was exposed to training from point C_1 onward. T_1 did not receive training until immediately prior to the room switch (tape 16).

Overall Increases in Control: Day to day levels of pupil time on-task performance throughout the study are shown in Figure 2. The TOT figure points are expressed as percent of TOT in relation to total time on camera for all pupils, regardless of teacher or room. As can be seen, during the pretreatment phase, TOT behavior was at its lowest (50% to 60%). Following the application of treatments at points C_1 and C_2, mean TOT behavior for all pupils increased and then tended to stabilize at about the 80% level. As predicted, the major exception to this shift occurred at point C_2 when the teachers switched rooms. Pupils adapted quickly to the switch, and their TOT behavior returned to the 80% level. In short, the data reported in Figure 2 support the conclusion that the experimental treatments outlined earlier did in fact lead to predicted overall increases in desirable pupil behavior.

Teacher Behavior: Figure 3 outlines the positive verbal and nonverbal reinforcement rates of each teacher at each phase in the study. In addition to denoting the extent to which each teacher actually employed these techniques, the data reflect the effectiveness of the training procedures.

In the pretreatment phase (prior to C_1), T_2 maintained a partial reinforcement rate of approximately .50. Following initial training, she began to reinforce pupil responses approximately on a one-to-one basis. Note that in tape 16, T_2 more than tripled her reinforcement rate. At this point she was, on the average, making three or more reinforcing statements for every pupil response. Following the room

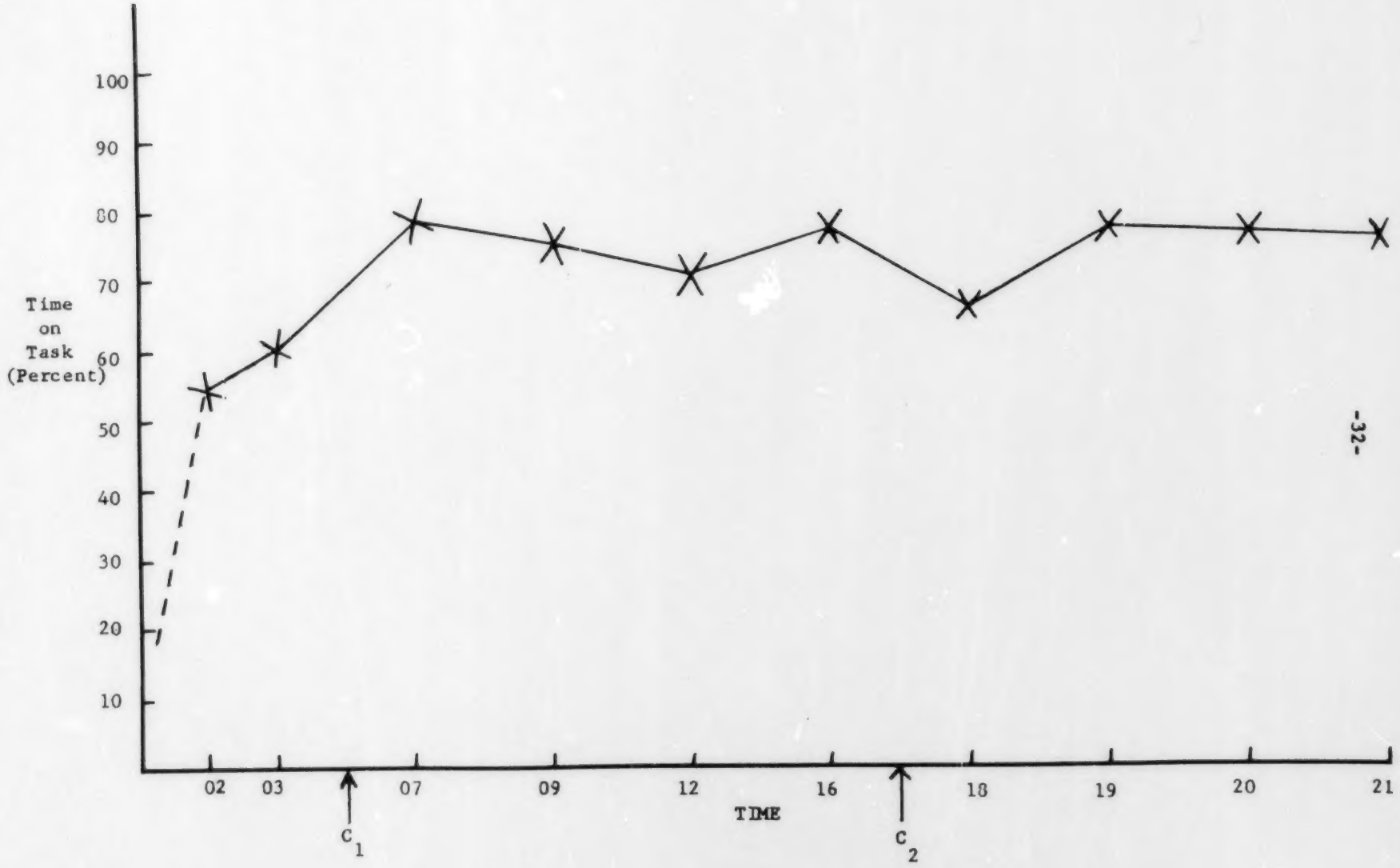


Figure 2. Percantage of Time on Task Behavior, All Pupils Regardless of Room and Lesson Type

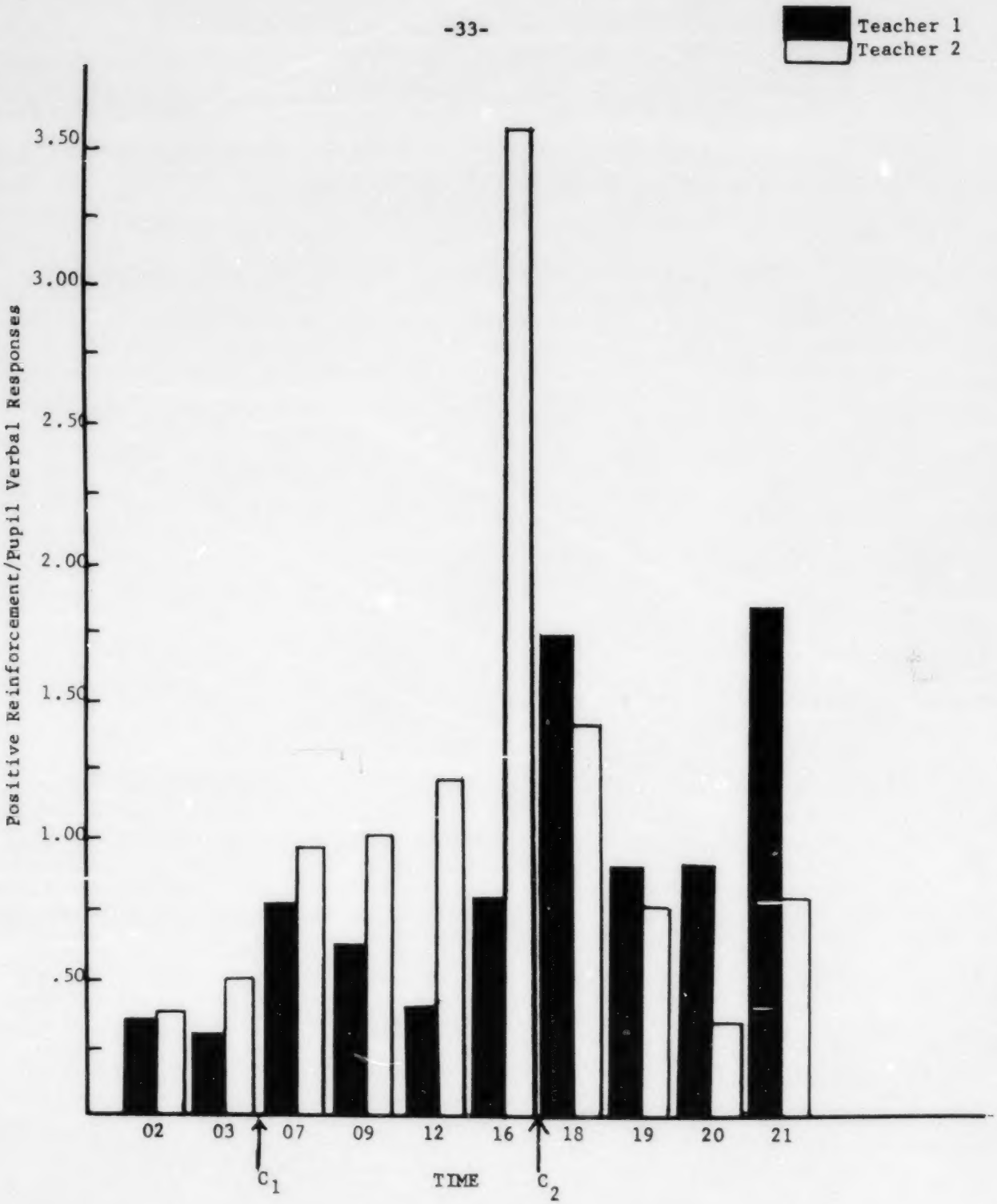


Figure 3. Rates of Positive Reinforcement Employed by Teachers 1 and 2

change (C_2) she returned to the stipulated training rate of approximately 1.0.

The reinforcement rate employed by T_1 in the earlier phases of the study was quite erratic in comparison with T_2's performance for that period. With the onset of transfer of control, T_1's reinforcement rate climbed above his earlier performance on tapes 2 and 3. These gains occurred before he received training, and were most clear-cut in tapes 7 and 9. T_1's reinforcement rate following initial training (tape 16) approached and then remained at or slightly above the one-to-one rate.

Pupil Time-on-Task Behavior Under Each Teacher: The average amount of time the pupils spent on lesson-relevant tasks with each teacher, is shown in Figure 4. The regular teacher's (T_1) success in maintaining pupil TOT behavior fluctuated a good deal throughout the study. Pupil attention for T_1 was surprisingly high in the initial tapes. Even so, gains above this initial level were realized following the transfer of control from Room B to Room A. High pupil TOT behavior from tape 16 on was closely associated with T_1's training in and use of reinforcement techniques and teaching strategies.

Turning to TOT pupil behavior for T_2, note that it rose to the 75% level early in the study, and remained at or above that level from then on.

Discrete Pupil Behavior Analyses: Independently of the TOT analysis of the tapes, a second team of raters analyzed discrete pupil responses. Several types of educationally desirable and undesirable behaviors were rated. These data are reported in Figures 5 and 6.

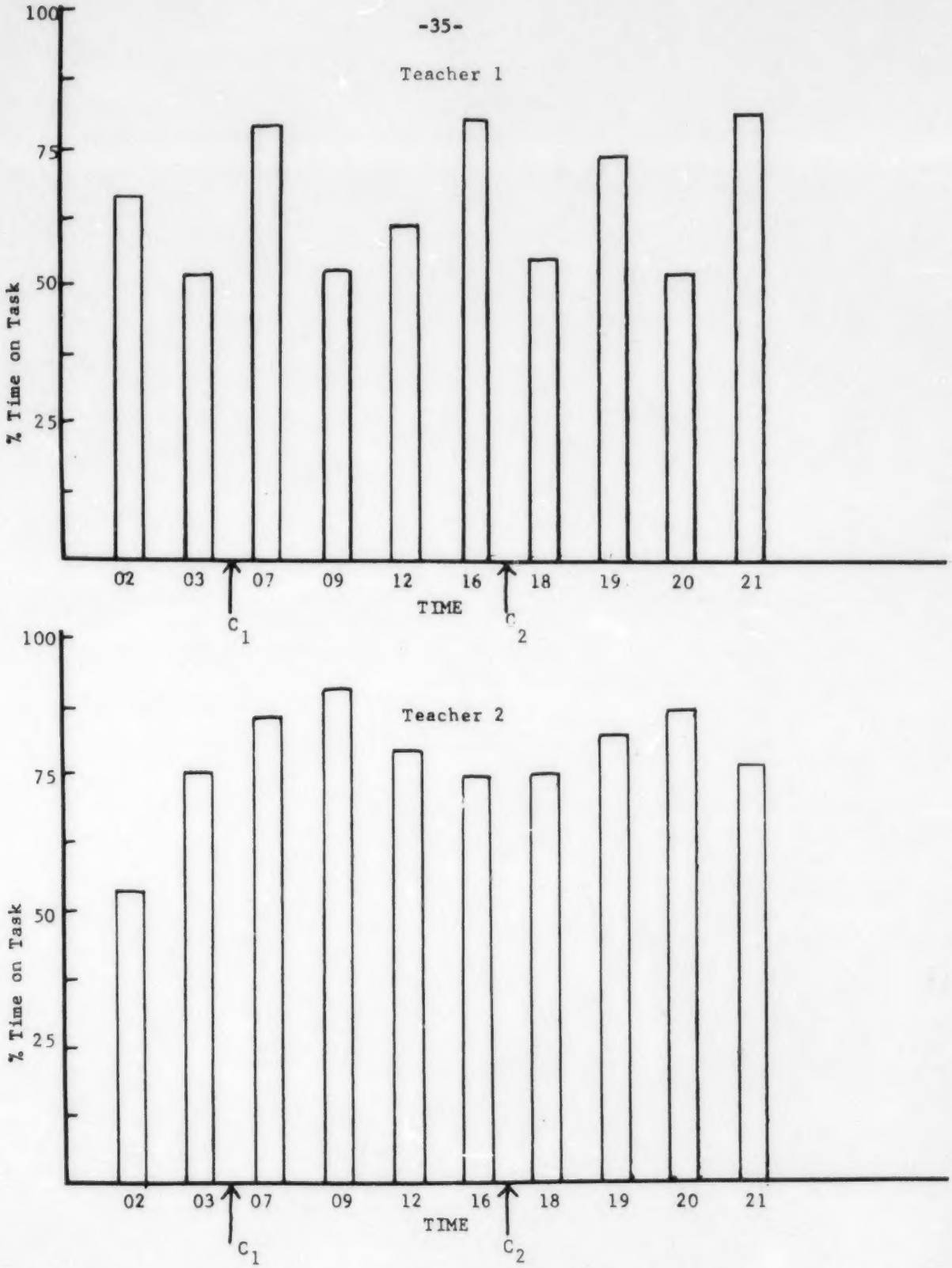


Figure 4. Percent Time on Task in the Classroom for Teachers 1 and 2

In Figure 5, Handraising is contrasted with Digressive Motor Behavior, and in Figure 6, Lesson-Participation Behaviors (Pupil Questions, Answers, Comments) are pitted against Lesson Disruptive Behaviors (Digressive Verbal, Aggressive Motor, Negative Verbal Pupil Responses). Handraising is contrasted with digressive motor behavior as it is essentially incompatible with the latter. It cannot be said that handraising per se is intrinsically desirable. However, it is a precurrent behavior that requires the pupil to be in the room, in his seat, and most importantly, directly involved in what is going on in the classroom. Digressive motor behavior, on the other hand, involves "tuning out" the lesson by engaging in gross movement patterns which interfere with pupil attention. The same rationale applies in comparisons of lesson-participation versus lesson-disruptive behaviors.

Both figures should be read as follows. The horizontal mid-line (marked 0) in each figure indicates that the desirable and undesirable behaviors in question occurred with equal frequency. Bars above the line indicate that the desirable behavior occurred with greater frequency than its counterpart, and in what proportion.

Figure 5 shows that during the pretreatment phase, handraising was nonexistent for both T_1 and T_2. From this point onward a substantial shift can be seen. Both transfer and training effects occurred for T_1 (see Figure 5). In addition to reflecting transfer of control effects up to and including tape 12, the data show that T_1 was able to enhance

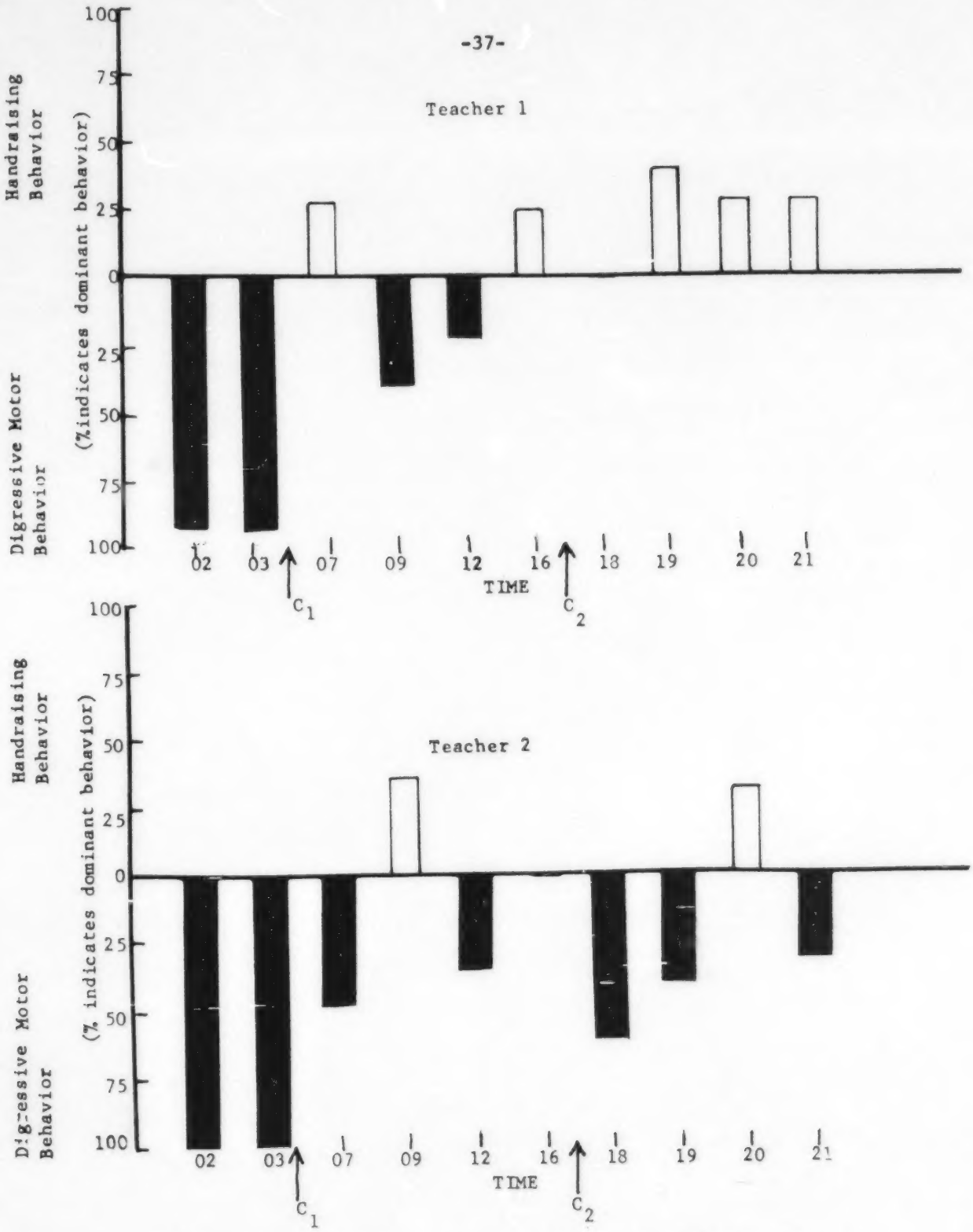


Figure 5. Handraising and Digressive Motor Behaviors for Teachers 1 and 2

handraising at the expense of digressive motor behavior to an even greater extent following training. The increase in handraising for T_1 was particularly significant in tapes 7 through 12, as it had not occurred during pretreatment. The shift then is directly attributable to the transfer of control from Room B and T_2 to Room A where T_1 was teaching.

T_2 never quite achieved the continuous dominance of handraising over digressive motor behavior as did T_1. However, the data in Figure 6 show that pupil verbal responses to lesson content were emphasized by T_2.

Lesson-participation and lesson-disruptive behaviors are contrasted in Figure 6. The bars in these graphs, as in Figure 5, represent percentage of lesson participation behavior minus disruptive behavior. They show which behavior occurred in greatest strength on each tape, and the extent to which it predominated. Pupil behavior for T_1 improved until tape 12 of the first experimental phase, at which time it fell off. This improvement represented the transfer of desirable behavior from Room B conditions and treatment to Room A pupil-teacher interactions. Upon T_1's application of relevant teaching techniques (tape 16), however, positive behavior increased again. The increase in undesirable behavior at tape 18, is accounted for by the switching of T_1 to the room supporting the teaching techniques, i.e., it presented a discrepancy for pupils, requiring adjustment. Desirable pupil behavior increased for T_1, after tape 18 and stabilized at a fairly high level toward the end of the fourth experimental phase.

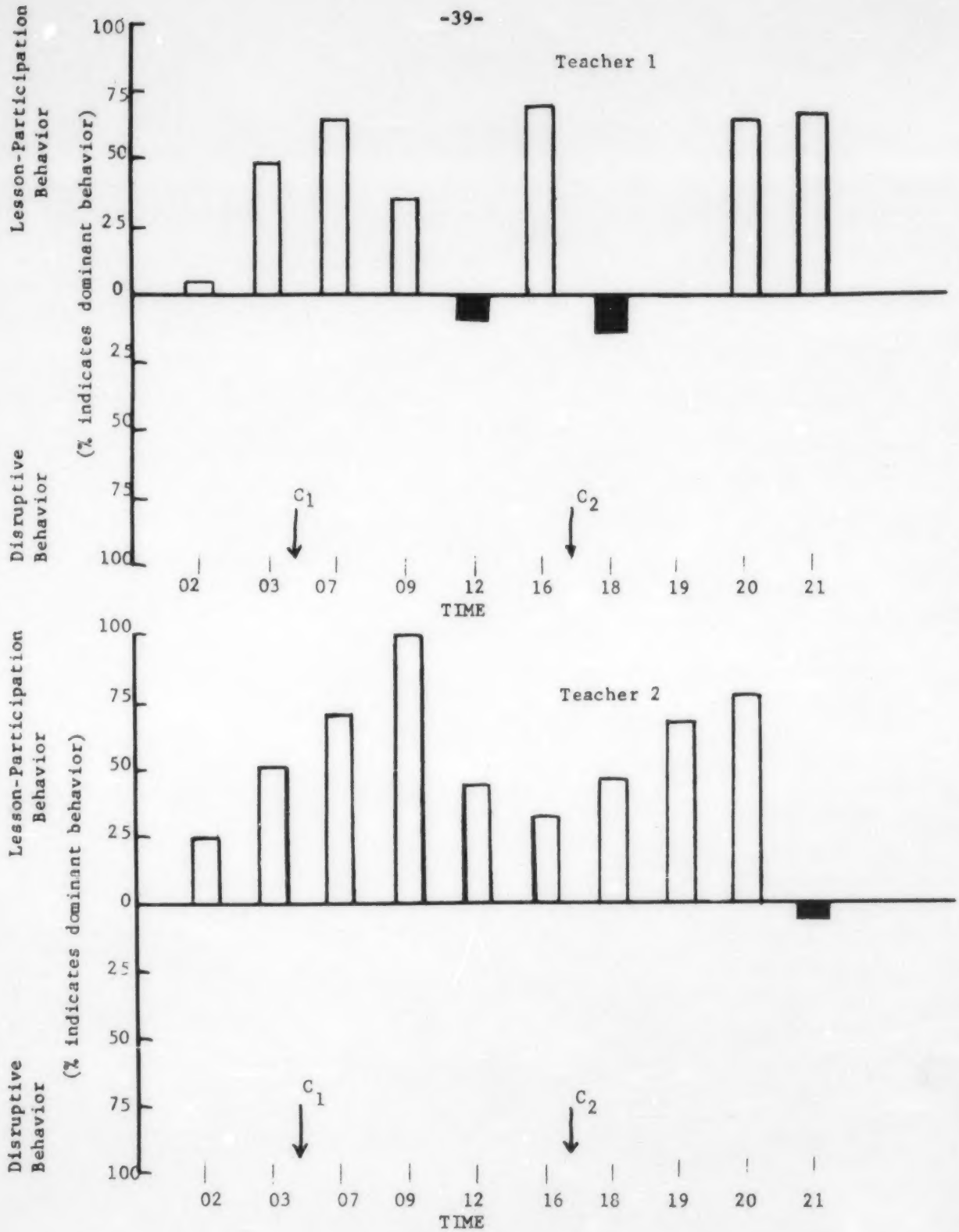


Figure 6. Lesson Participation and Disruptive Behaviors for Teachers 1 and 2

The power of the techniques employed by T_2 to increase desirable pupil behavior is shown in Figure 6. Apart from the "last-day of-the-experiment" (and also the last day of teaching at this school) ascendency in disruptive behavior, high levels of desirable pupil participation were maintained throughout. This behavior was maintained by T_2 under both room conditions.

DISCUSSION

In general, the data support the hypotheses of the study: The systematic application of teaching techniques designed to elicit and reinforce specific forms of pupil behavior led to relatively stable and desirable modifications in that behavior. The desirable behavior thus produced by the teacher was successfully transferred from one classroom to a second room and a different teacher. It should be clearly understood that the transfer of desirable pupil behavior from Room B to Room A cannot be explained solely in terms of generalization effects. Pupils were clearly given to understand that they could only gain entrance to Room B by behaving in certain ways in Room A. It should also be noted that this transfer of control stratagem produced basic changes in the nature of the reinforcers operating in each room. While point-getting behavior was the same in both rooms, it led to different consequences. In Room B, points were directly backed up by an external reinforcement system. In Room A, points earned in the same manner simply led to the opportunity to enter an environment where the pupil could expect more tangible feedback.

Now whether points earned in Room B generally had greater reinforcement value than points earned in Room A is a moot point. In any event, points produced substantial increases in desirable pupil behavior under both conditions.

The results of the study would be even more clear-cut had the pretreatment tapes revealed less pupil TOT behavior and lower teacher reinforcement rates. While T.V. equipment desensitization had begun just prior to tapes 2 and 3, it is highly unlikely that it was complete by this time. It is not unreasonable to assume that the introduction of equipment and the notion that one would be televised led to more exemplary behavior on the part of pupils and teachers. As taping continued day in and day out, one would expect such effects to wear off. If this is true, then the gains in desirable behavior noted early in the second phase were partially masked by these Hawthorne effects, and as they wore off, one could expect decrements in desirable performance.

In reexamining the data in this light (cf. Figure 2), pretest pupil performance does seem surprisingly high, especially in view of the fact that immediately prior to taping, the major complaints from school personnel were that these pupils could not be persuaded to stay in the room through the day, and those who were in the room at a given time were so noisy that they interfered with other classes. However, when one looks for a general decrement in desirable behavior later on in the study (cf. Figure 4) it fails to materialize. T_1's pupils show a drop in TOT behavior in tape 9, but this is not reflected in T_2's class.

Fluctuations in desirable pupil behavior appear to be closely linked to the teacher's reinforcement rate. Figure 3 shows that T_2's reinforcement rate markedly increased during tape 16. Concomitant with this radical increase, pupil participation in the lesson and TOT behavior tended to drop off, while disruptive behavior increased. A similar though less clear-cut correspondence between an inflated teacher reinforcement rate and a drop off in desirable pupil behavior can also be seen for tapes 12 and 18.

The trend may be due to satiation effects produced by a surfeit of teacher reinforcement. If true, that which is ordinarily reinforcing may take on aversive qualities. In any event, problems of scheduling reinforcement in the classroom require further study. In addition to "overpraise," the crucial issue of fading from tangible reinforcers to symbolic reinforcers has hardly been explored in terms of the present context.

Other findings of interest could be reported, but will only be mentioned at this time. They include: the type of lesson taught by the teacher and the degree to which it lends itself to the use of reinforcement; effects of pupil reinforcement on teacher behavior; the facilitation of modeling effects of one pupil on another through teacher reinforcement; the effects of disassociating the reinforcement function from the teacher; changes in teachers' perceptions of classroom climate, pupils and themselves as teachers; and, training techniques which facilitate the manipulation of reinforcement schedules employed by the teacher.

Finally, it is suggested that what research of this type so blatantly sacrifices in terms of precise experimental control, may be compensated for in other respects. In addition to identifying salient pupil and teacher variables that require further study under more controlled conditions, it can be expected to lead to greater sophistication in the definition of teaching techniques that work.

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